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PRODUCT PACKAGING FOR BATTLEFIELD AWARENESS AND DATA DISSEMINATION

ISX Corporation

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APPROVED: *William E. Rzepka*

WILLIAM E. RZEPKA
Project Engineer

FOR THE DIRECTOR: *Northrup Fowler*

NORTHRUP FOWLER, III, Technical Advisor
Information Technology Division
Information Directorate

PRODUCT PACKAGING FOR BATTLEFIELD AWARENESS AND DATA DISSEMINATION

Marc Zev

Contractor: ISX Corporation
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Principal Investigator: Marc Zev
         Phone: (818) 635-6847
AFRL Project Engineer: William E. Rzepka
        Phone: (315) 330-2762

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Marc Zev

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ISX Corporation
4353 Park Terrace Drive
Westlake Village CA 91361

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13. ABSTRACT *(Maximum 200 words)*

The goal of the Product Packager for BADD program was to conceive, develop and enhance information packaging technology that would support the information requirements of battlefield awareness situations. Multiple information packaging architectures to support information push were designed and developed including the Warfighter's Information Packager (WIP), a suite of distributed components that allows users to easily obtain information from diverse heterogeneous data sources and to display the results in a user-defined predictable manner. WIP uses a combination of AI and non-AI technologies to take advantage of the information push technology being developed for DARPA's Battlefield Awareness and Data Dissemination program. Used together, the WIP components create a distributed system that serves as a valuable tool for information analysis.

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INTRODUCTION

This project was conceived as a technology enhancement effort in support of DARPA's Battlefield Awareness and Data Dissemination (BADD) Advanced Concept Technology Demonstration (ACTD). The goal and vision of the BADD program is that it will develop, install and evaluate an operational system that allows commanders to design their own information system. BADD will deliver to Warfighters an accurate, timely, and consistent picture of the joint/coalition battlefield; and provides access to key transmission mechanisms and worldwide data repositories.
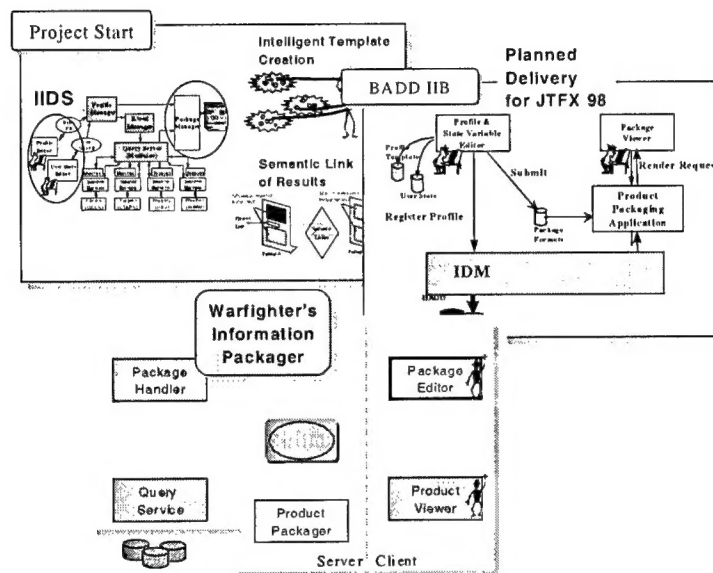

Figure 1, The Evolution of the WIP system

The goal of the Product Packager for BADD program was to conceive, develop and enhance information packaging technology that would support the information requirements of battlefield awareness situations. To this end ISX designed, and in some cases developed multiple information packaging architectures to support information push in conjunction with the BADD Information Dissemination Manager (IDM) system. Figure 1, portrays the evolution of the information packaging systems developed under this contract. At the start of the project ISX intended to develop advanced technology solutions that would enhance the work ISX completed under the Intelligent Information Dissemination Server (IIDS) project. The enhancements included formulating a system to intelligently create information templates and developing strategies to provide heightened understanding of query results by linking the results through the use of a semantic engine. Upon direction of the DARPA Program Manager, Bob Beaton, ISX developed a system that was to be integrated with the BADD

Phase II B system. This system was meant to be a more sophisticated Profile Editor than was being developed under the BADD program directly. Just two weeks before the beta version of the Profile Editor was to be delivered Bob Beaton asked ISX to cooperate with Lockheed-Martin ISC and USC/ISI and to produce a system that combined the technologies from each of the companies. The final product to emerge from this program is the Warfighter's Information Packager (WIP) which was developed in conjunction with USC/ISI (funded under a separate contract) After working with Lockheed-Martin for six-months they were re-directed.

The Warfighter's Information Packager is a suite of distributed components that allows users to easily obtain information from diverse heterogeneous data sources and to display the results in a user-defined predictable manner.

WIP is based on research performed under DARPA's Intelligent Integration of Information program. It uses a combination of AI and non-AI technologies to take advantage of the information push technology being developed for DARPA's Battlefield Awareness and Data Dissemination program.

Used together, the WIP components create a distributed system that serves as a valuable tool for information analysis by:

1. Allowing the user to define high-level information products, information packages, and specific tasks and roles; information packages are parameterized by user interests

2. Providing a web-based package viewer that dynamically constructs packages for the user on demand

3. Allowing users to make high-value complex information requests that can span multiple data sources without *a priori* knowledge of the schema of the sources

The WIP system addresses the problem of how to support the needs of users to view and manipulate required data in an information push environment. In such an environment, traditional query-based data retrieval is replaced by asynchronous information delivery based on information profiles registered with sources.

Information push is intended to address the following problem: When information is generated in many sources and on a continual basis, it is onerous, inefficient, and impractical to require users to issue multiple repeated queries for their information. It would be far more efficient if responsibility for disseminating the information were transferred to the sources. The sources contain the actual information and can more readily detect changes. In such an architecture the consumer registers a request for information with the source, or with a system overseeing the source.

There are many ways in which such a scheme may be implemented. The

BADD program was established to deal with the issue of information push in a battlefield environment. BADD has chosen an architecture wherein information requests (known as "Profiles") are registered with a central Information Dissemination Manager (IDM), and the IDM ensures that data matching the profiles is transferred to the user's locally deployed sources. This still leaves open the questions of how to construct and use applications that require the pushed data, and how to determine which profiles must be registered in order to support these applications. The WIP system addresses these issues. WIP provides end-users with a facility for producing an *information package*. Using IDM, WIP ensures that necessary data is pushed to locally deployed sources when it is available. A *Query Service* satisfies information package queries by retrieving data from the deployed sources.

In general, a warfighter has a task to perform and has specific information needs to accomplish the task. Information needs in BADD are specified as *Package Templates* that do not necessarily match up conveniently with actual source queries. This is due to the profile registration facility of the IDM having a language far less powerful than familiar database query languages. The data that is delivered to the end-user's computer environment may be in formats that differ from one environment to the next due to variations in data management facilities. For example, one warfighter may have a database facility available for a certain type of data, while another may not. In such a situation the IDM will deposit the information in a file. For similar reasons, data storage formats used in the deployed sources may differ from those used in original sources against which the profiles are registered. In addition, data needed for a single task may end up being distributed over different deployed sources. The end result is that any processing of deployed information will necessarily involve an information integration and/or translation task. Making WIP packages portable requires that this integration be done in a general manner and that queries to the query service be at a semantic level, independent of precise sources used and their organization.

For this reason, the ACME model [Lehrer, Zev. 1998] was used in the design of the Warfighter's Information Packager. The ACME approach describes a methodology of constructing information components that easily lend themselves to adaptation as agents. The following describes, briefly, the components that make-up WIP.

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WIP COMPONENTS

USER INTERFACE

WIP's user interface, developed at ISX, is composed of two main components: the Package Editor and the Product Viewer. The Package Editor provides an environment for creating information package templates. These templates include parameterized queries and display formatting information. WIP's query description methodology allows users to easily describe their information needs based on descriptive domain ontology. WIP's parameterization allows the dynamic modification of the precise semantics of queries without revising queries. This is accomplished by providing late-time binding of variables within the query expressions, enabling information requirements such as: "Get the target information for all targets on today's target list" to be expressed.

The Package Editor also performs the registration of necessary data profiles so that data can be deployed to the user's system. The Product Viewer, discussed more thoroughly later, collects the information results from the information integrator module, formats them based on the format defined in the package template, and displays the packaged product to the user.

QUERY SERVICE

The Query Service module is an application of CSIMS AI technology, developed at USC/ISI. CSIMS serves as a single access point for information distributed over a collection of heterogeneous data sources. The underlying technology is described below. During the specification phase, the Query Service uses its knowledge of the distribution of data over sources accessible to the IDM (also mirrored, as noted earlier, by the distribution of potential data over local deployed sources) to provide the Package Handler with the identity of sources against which profiles must be registered. This enables the package being defined to have the information required for its operation at utilization time. Furthermore, the Package Handler uses CSIMS' capability to determine which queries will have to be asked of each component source to satisfy the package's. The package defines the profiles that will eventually be handed to the Package Handler for processing and registration.

INFORMATION PACKAGING

The information packaging components of WIP are handled by utilizing two

components; the Package Handler and the Product Packager. The Package Handler maintains a local store of profiles defined specifically by WIP, handles communications, and has the responsibility of initiating the accumulation of results for specific packages. As currently implemented, in the demonstration system, WIP does not communicate with IDM. However, the introduction of one or more Data Services is easily handled by the systems design. WIP registers and de-registers these profiles with the IDM.

CONTROL TREADS

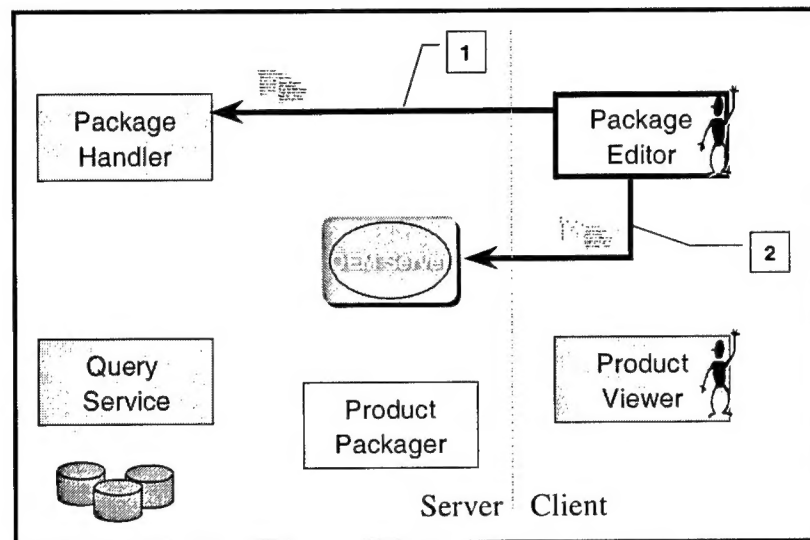## INFORMATION OBJECT SPECIFICATION AND REGISTRATION

Figure 2. Information Object Specification and Registration Phase

Figure 2 illustrates the control flow of the information object specification and registration phases. During the first phase, information objects; namely, Package Templates and State Objects, are created or modified with the Package Editor. The Package Template is the parameterized definition of both the information requirements (queries) and the display formatting that the user is interested in. The Package Template is composed of formatting objects like Headers, Separators, Paragraphs and Query to describe how the information product will eventually look. The State Object is the encapsulation of the variables that are used to instantiate the parameters in the Package Template. The instantiation takes place at the time of registration within the Package Handler. Refering to the links in the figure above:

1. A Package Template / State Object pair are registered with the Package Handler
2. Package Templates and State Objects are maintained in the systems central storage (OEM Server)

INFORMATION GATHERING

Figure 3 shows the flow of control for the information-gathering phase of the WIP system. The Package Handler is responsible for instantiating the Package Template and State Object together, storing the instantiated Package and evoking the Product Packager to collect the query results from the Query Service, formatting the Product and storing it.
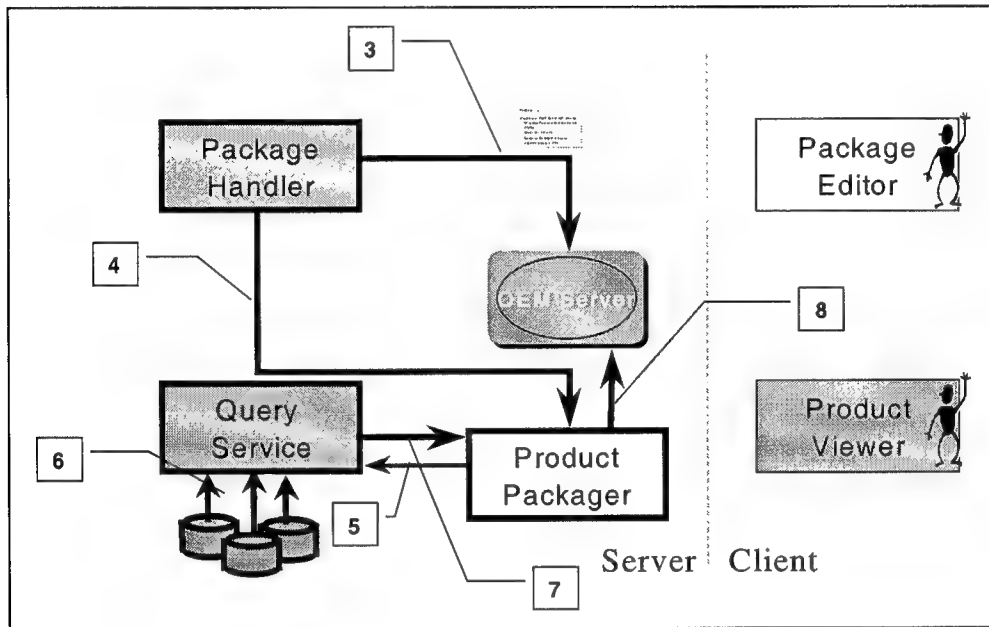

Figure 3. Information Gathering Phase

Refering to the links in Figure 3:

3. An instantiated Package is stored centrally
4. The Product Packager is evoked to start building the Product
5. The queries are sent to the Query Service for satisfaction via decomposition into individual data source queries.
6. The Query Service collects the data source results and aggregates them
7. Returning the results to the Product Packager for formatting and
8. Storage in the central store.

PRODUCT VIEWING

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Figure 4 shows the WIP flow of control when a Product is requested for viewing. The user, to request a Product to be rendered, uses a lightweight HTML client. At that time a request is made to the Product Packager.
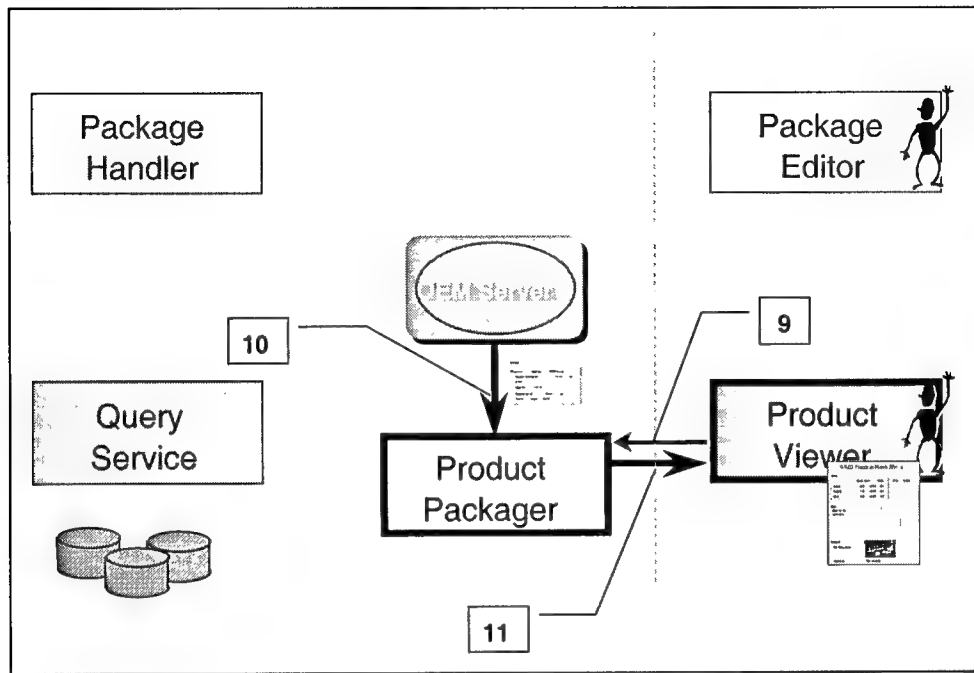

Figure 4. Product Viewing Phase

Refering to the links of Figure 4:

9. A request for a Product is made from the Product Viewer
10. The Product Packager retrieves the formatted Product from the central store and renders it based on the user specified parameters
11. The Product Packager returns the rendered Product to the Product Viewer for display.

PACKAGE UPDATING

Figure 5 demonstrates another control thread, which occurs asynchronously with respect to the other control threads. This flow shows the WIP reaction to a change being made to a State Object. When the change occurs the central store (OEM Server) notifies the Package Handler of the change, which then searches through all of the registered Packages for those registered with the changed State Object. It finds those Packages and re-registers them with the new values of State Object.
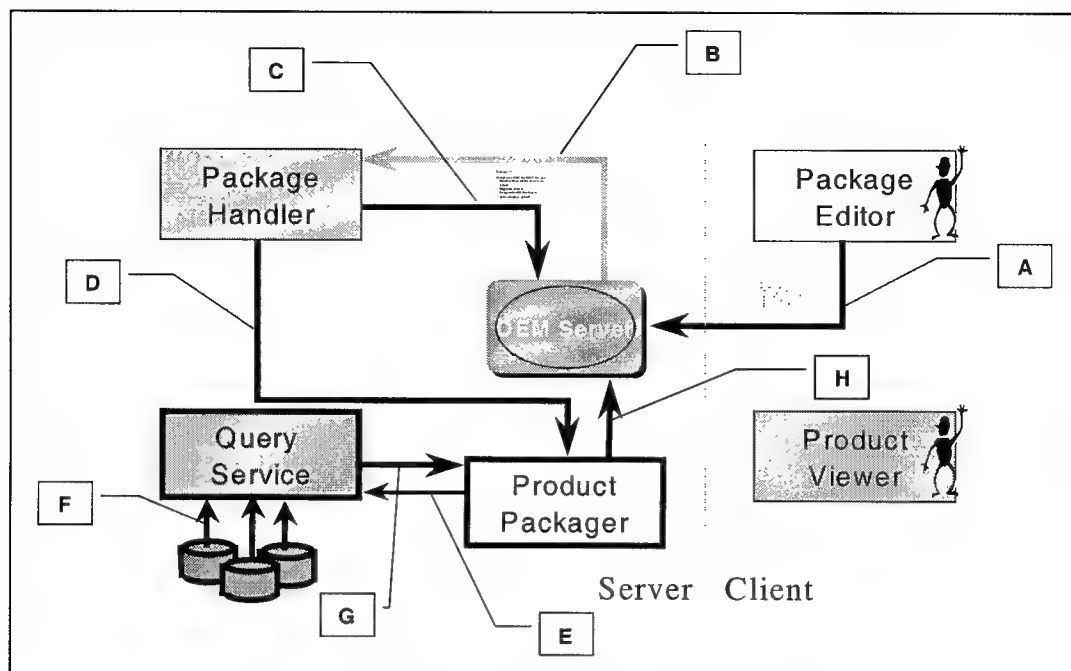
Figure 5. Package Updating Phase

Refering to the links in Figure 5:

A. Store modified State Object
B. The Package Handler is notified. The current list of registered Packages is reviewed and the ones that use the changed State Object are un-registered, re-instantiated and then
C. Registered again, by
D. Evoking the Product Packager, which in turn
E. Submits each query to the Query Service, which
F. Performs the single source queries and aggregates the results.
G. Query results are returned and the
H. Product Packager stores the new Product in the central store.

APPLICATION INNOVATION

The information integration functionality provided by the Query Service, which uses AI planning technology, enables WIP to be operational on different information sources in multiple existences, including databases, legacy information systems, image sources, sensors, and the World Wide Web. The use of independent information objects by the information packaging components (Package Editor, Package Handler, Product Packager and Product Viewer) combined with the use of a common domain ontology significantly extend WIP's usability to the end users. Combined, these two functions not only provide information that directly meets users' needs, but also supply and present context and other related information that makes the required information meaningful.

It is informative to point out that although WIP is developed for the BADD system in a military domain, the concept and WIP system itself is easily applied to other applications. Specifically, WIP can be adapted to a personal digital assistant in an information rich environment to help a user collect information based on particular information needs. The information can then be presented in a format compliant with the user's preferences.

EVALUATION

The WIP system is the integration of two distinct technologies: query service (mediation) and information packaging. The development of each of these technologies has been pursued independently in this program. Prototype systems with limited functionality exist for the components of the Product Packager. The query service, CSIMS, is responsible for satisfying information requests and it currently supports several projects in extended prototype form. The Warfighter's Information Packager is currently working in a demonstratable fashion. ISX is currently pursuing operational users for the system, either with the CSIMS query service or another user specified service.

At this time other DARPA projects, such as, ACOA and Genoa, have expressed interest in the WIP information packager. JICPAC has also expressed an interest in installing the system in the JICPAC laboratory for operational test and evaluation.

REFERENCES

[Arens et al. 96] Yigal Arens, Craig A. Knoblock, and Wei-Min Shen. *Query Reformulation for Dynamic Information Integration.* Journal of Intelligent Information Systems, Vol. 6, No. 2/3, 1996.

[Arens et al. 93] Yigal Arens, Chin Y. Chee, Chun-Nan Hsu, and Craig A. Knoblock. *Retrieving and Integrating Data from Multiple Information Sources.* International Journal of Intelligent and Cooperative Information Systems. Vol. 2, No. 2. Pp. 127-158, 1993.

[Dukes-Schlossberg et al. 97] Jon Dukes-Schlossberg, Yongwon Lee, and Nancy Lehrer. *IIDS: Intelligent Information Dissemination Server.* Proceedings of MILCOM 1997.

[Goldman et al 96] Roy Goldman, Sudarshan Chawathe, Auturo Crespo, Jason McHugh. *A Standard Textual Interchange Format for the Object Exchange Model (OEM).* Technical Report, Stanford University, 1996.

[Knoblock 95] Craig A. Knoblock. *Planning, Executing, Sensing, and Replanning for Information Gathering.* Proceedings of the Fourteenth International Joint Conference on Artificial Intelligence, Montreal, Canada, 1995.

[Knoblock 94] Craig A. Knoblock. *Applying a General-Purpose Planner to the Problem of Query Access Planning.* Proceedings of the AAAI Fall Symposium on Planning and Learning: On to Real Applications, 1994.

[Lehrer, Zev. 1998] Nancy Lehrer, Marc Zev. Architecture for Component-based Mediation Environments (ACME). ISX Internal Report, 1998.

Product Packaging for BADD Final Report

Appendix A:

Warfighter's Information Packager Demonstration Walk-Through

WIP User Guide

The following is meant as an aid for someone performing a demonstration of the Warfighter's Information Packager. The document includes both "words" that the demonstrator can use as part of their "patter" while doing the demo and "aside" information for the demonstrator to know. The document is written in a style that often does not adequately distinguish the two types of information. Although a lot of screen images have been included here, the most effective way to use this document is to run the demo in conjunction with reading the text.

The demo can be found at http://acme.isx.com/wip/demo3/. To receive a username and password, please send e-mail to mzev@isx.com

Use Case

There are two user interfaces that provide access to WIP: The Package Editor and the Product Viewer. The Product Viewer is a lightweight web-based system that allows the user to pick from the list of registered packages and view them as products in a variety of different display protocols. The Package Editor provides a mechanism for users to create, modify and delete Package Templates, State Objects and the components that make them up. The Package Editor also gives the user a way to register and unregister packages within the WIP system.

The following is an example path through the WIP system. This is not the only path, but it has been well tested and is a good recipe for an informative demonstration.

The outline for the demonstration is partitioned in two parts:
1. Show the Product Viewer
    1.1. Review a (pre) registered Product
    1.2. Show off the display items within the product (headers, profiles, etc.)
2. Show the Package Editor
    2.1. Review the Package Template used to create the viewed product
    2.2. Point out the use of State Variables
    2.3. Review the State Object used to create the viewed product

1. The Product Viewer
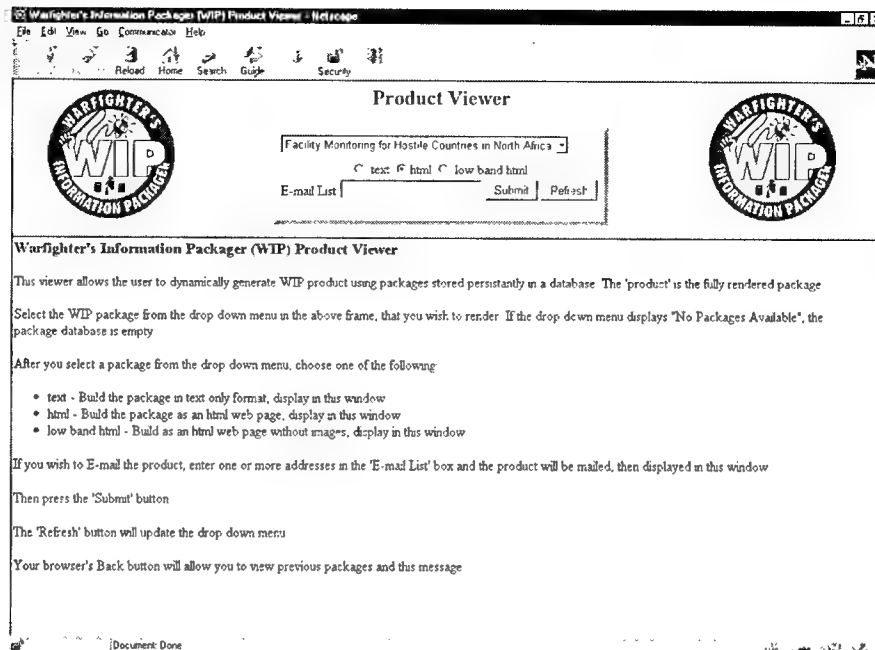
The Product Viewer is a light-weight browser-based application that uses CGI scripts and Java Script. The Product Viewer must be accessed from outside a firewall to ensure connection to the WIP server.
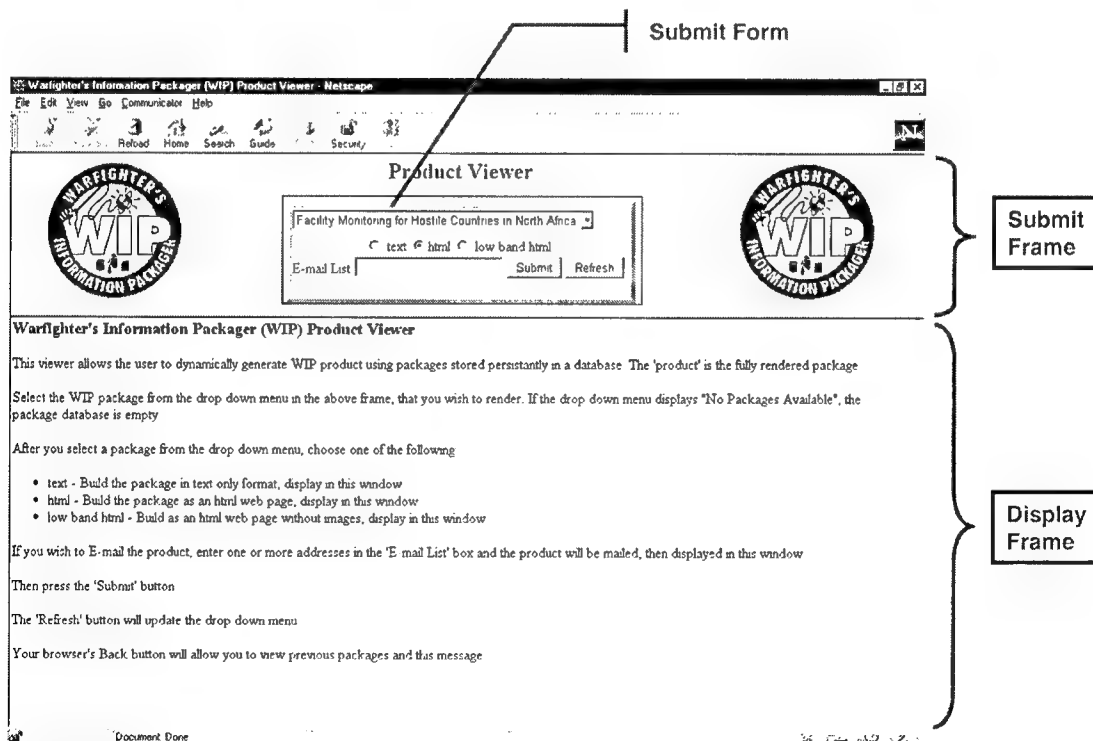
A close up of Submit Form containing details of the interface components is shown here:

Display Type Radio Buttons
Text, HTML or Low Bandwidth HTML

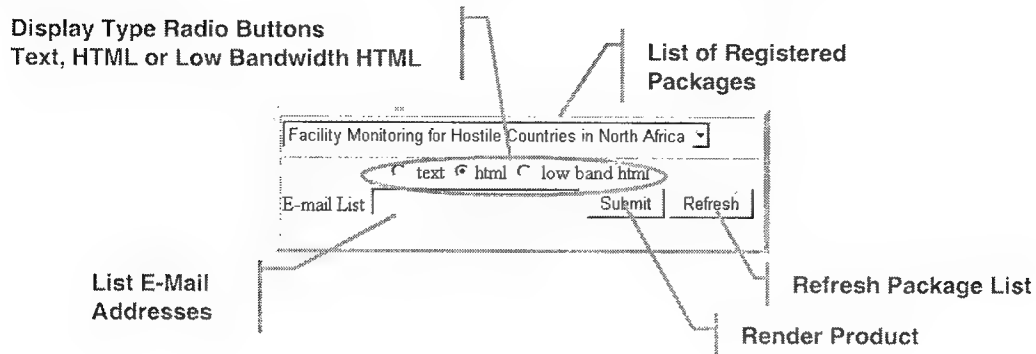List of Registered
Packages

Facility Monitoring for Hostile Countries in North Africa ▾

text ○ html ○ low band html

E-mail List [   ]   Submit   Refresh

List E-Mail
Addresses

Refresh Package List

Render Product

To get started, select a Package from the list: e.g. Facility Monitoring for Hostile Countries in North Africa

Facility Monitoring for Hostile Countries in North Africa ▾
Facility Monitoring for Hostile Countries in North Africa

E-mail List [   ]   Submit   Refresh
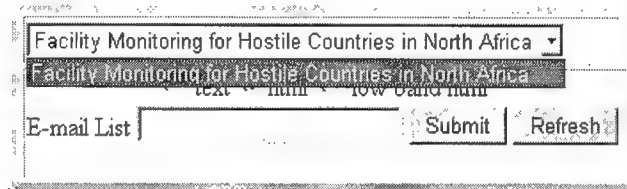
Next, activates the Render Product Package by clicking on Submit button. The rendered result will be displayed in the Display Frame.

1.1 Review the product

Some of the key features that will be displayed are Headers, Separators and Query Results. There are two formats for the query results, Tabular, as we see below and in Record Label Format.

Additionally, the user can specify whether the query result is placed "in-line" as above or as a link as seen below. Other features that can be displayed are hyper-links to other web sites. These links are static and are defined in the original Package Template. Images can also be specified. The image displayed is a thumbnail of the actual image; when clicked, the image will be displayed in its actual size.

One feature to note in the above screen image is that the rendering application does not need to know the resulting formats ahead of time; e.g. some of the results of the queries will be URLs while others will be images. When the renderer identifies a URL, it will

automatically create the appropriate hyper-link. The user need only click on the link to go to that site. Below we see the result of following the Reference link for the Algeria record above. That particular link is to the CIA World Factbook.
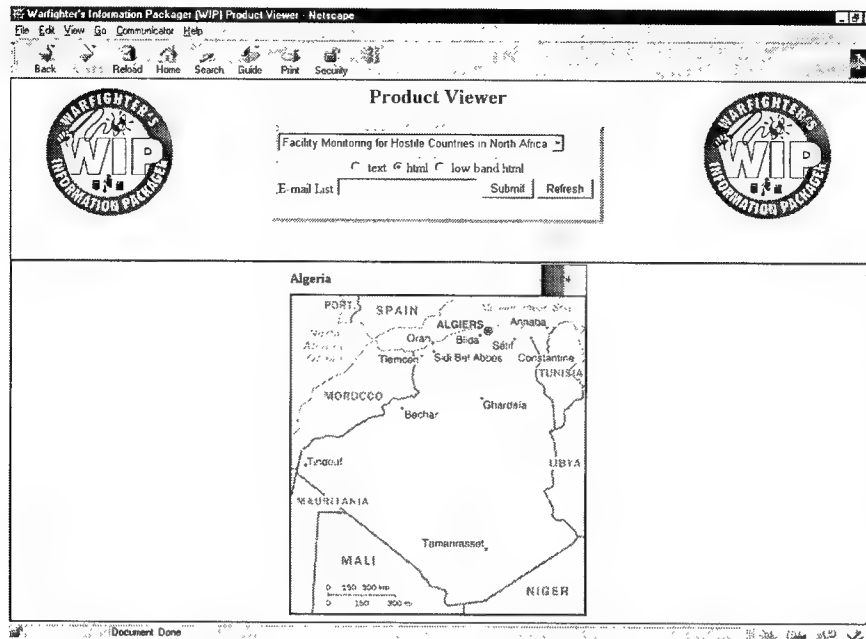
As seen above (and in detail below) some query results can be included as links to the result instead of "In-line".
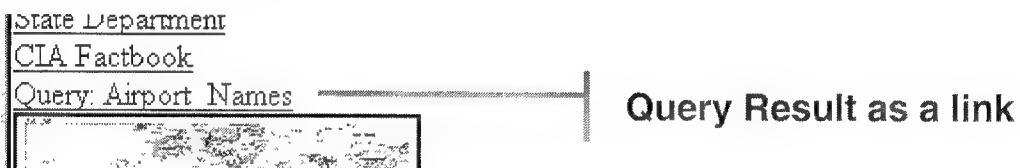
When a query result is a link, the data is not rendered unless and until the user explicitly requests it by clicking on the link. When the above link is clicked WIP will render and display the results of the query as shown below. Additionally, the following screen also shows how a result would be formatted using the Label Record format. The form is for the attribute labels to be displayed in the left-hand column of the two-column table. The same rules apply to these labels as those in the standard table format, including specialized names and ordering. When the Label Record format is in use one complete record will be displayed (vertically) and then the next record will be displayed. Each set will include the attribute labels.
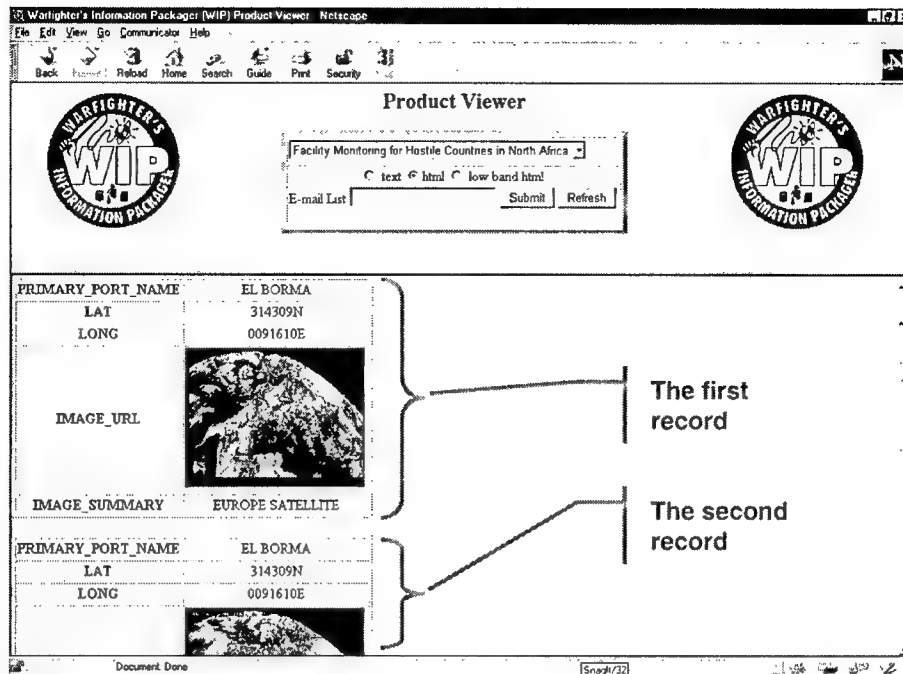
WIP provides three (3) ways to render a product. As an HTML document (as shown above) as a low bandwidth HTML document and as a text document. The different methods are to allow the user to make decisions about the display with respect to their own unique situation. When using the Low Bandwidth option images are not displayed automatically, they are all displayed merely as links to the images. This allows the user to only use bandwidth for images that they really want to see. See below.
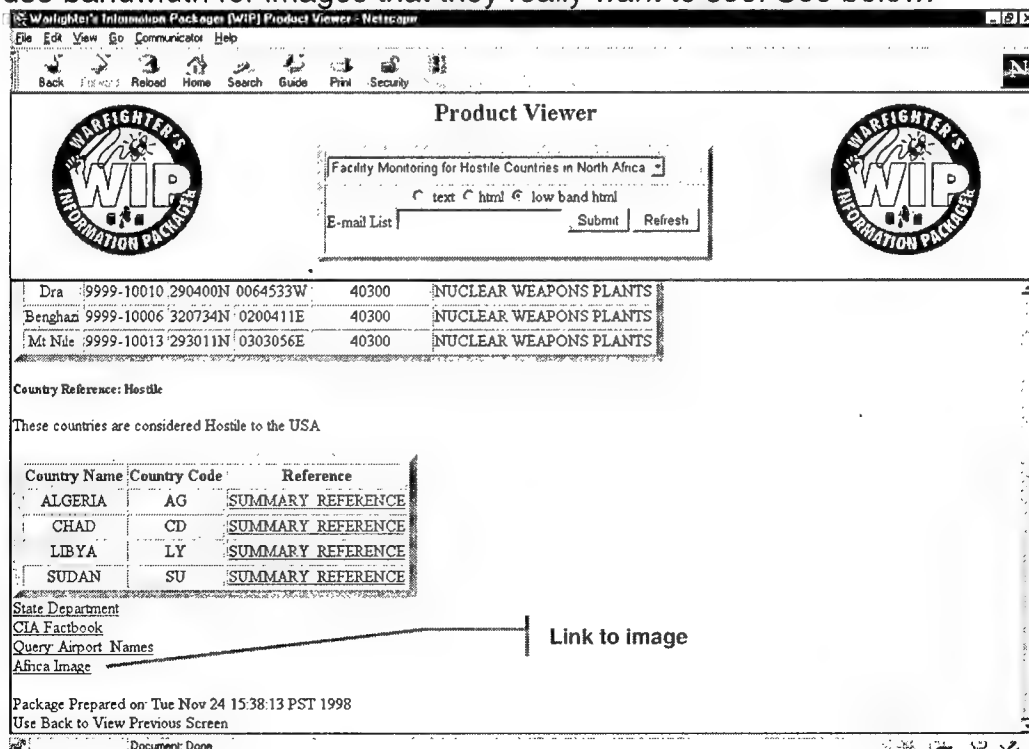
An alternative format is to have the result displayed as Text. In this form the assumption is made that the viewing device does not support HTML, and therefore is also probably limited by width (unlike HTML that scrolls horizontally). To accommodate this query, the results are not displayed as tables, regardless of what the Package Template specified. All query results are displayed in Label Record format.
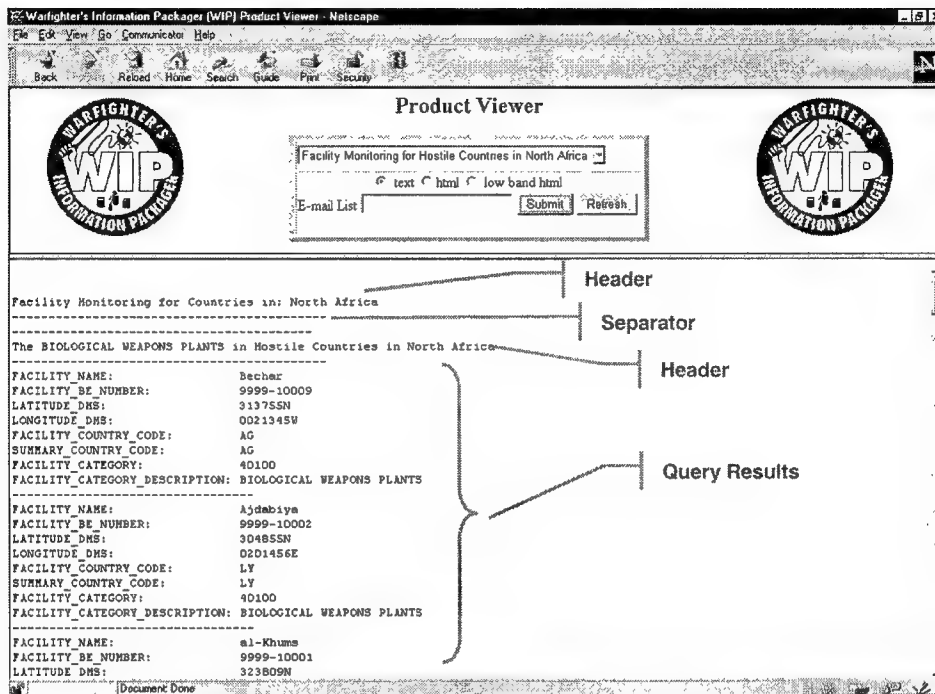
In the above screen shot the beginning of the Facility Monitoring for Hostile countries in North Africa package is being viewed.

Let us now look at the Package Editor, where the specification for this package was created.

3. Package Editor

The Package Editor was designed to be as user-friendly as possible, using convenient Tab navigation between most of the screens. In addition to the Welcome banner shown here a simple help screen is also provided.
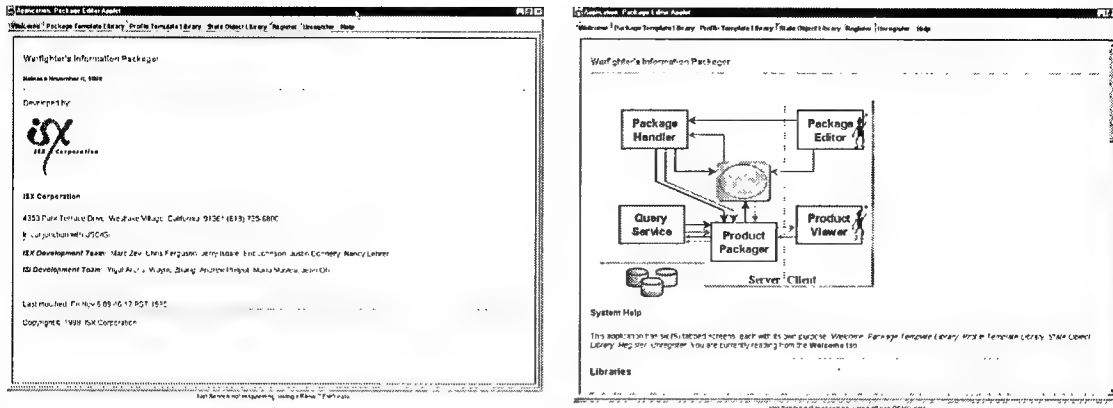
The specification of the Package Template is defined through the Package Template Library. Within this library the user can modify, copy or delete an existing Package Template or create a new one. The format of the Package Template Library screen is similar to the Profile Template Library and the State Object Library screens. The majority of the real estate on the screen is occupied by the object list, Package Templates, Profile Templates or State Objects as appropriate for each library. To the right of the list is the *List* **Button Set** and the *Refresh* **Button**. The List Button Set provide the functionality that allows the user to either create a new object (object in this context is meant to mean either Package Template, Profile Template or State Object depending on which library the user is in) modify an existing object, make a copy of an object and then edit it and remove an object from the library. The Refresh button is there to allow the user to update the list of objects displayed. If WIP is being used as single user system than this button can be ignored. However, if there are concurrent users that are creating and/or removing objects than the use of the Refresh button will ensure consistency with all the other users.

Package Template List
List of Package Template within library

List Button Set
Buttons to create,
modify, copy and
remove elements from
a list

Refresh Button
Resync data (only
needed when multiple
users are on-line)
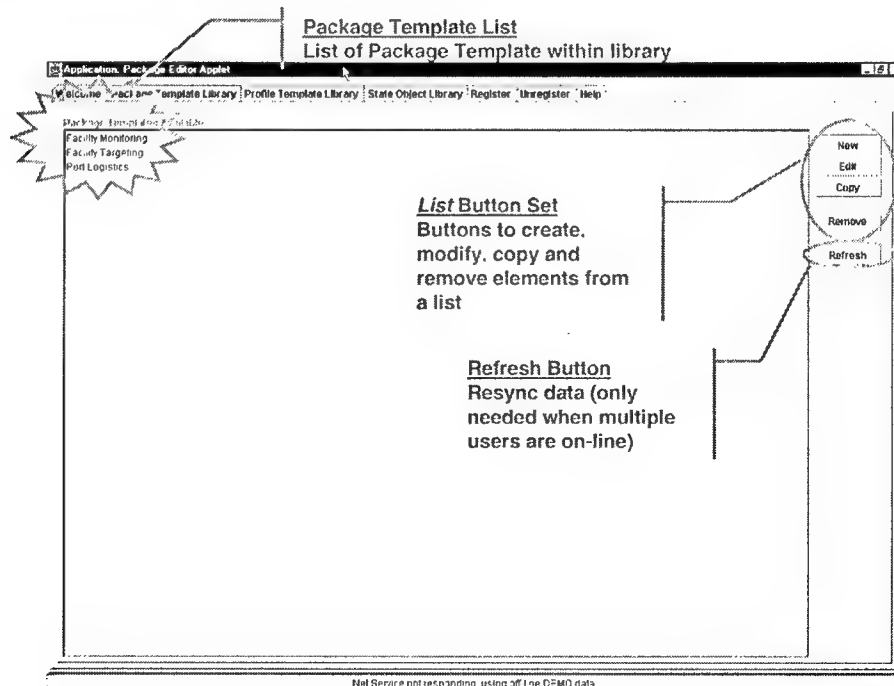
If the user chooses to create a new Package Template they will be required to specify both a list of Profile Templates and a display format. **Note:** The GUI uses nomenclature consistent with the BADD program and therefore the term used for query is Profile. The display format is a specification of the format that the query results will be displayed in.

The Package Template editing screen has three (3) distinct panels on it; the Meta-data Panel, the Format Panel and the Profile Template Panel.
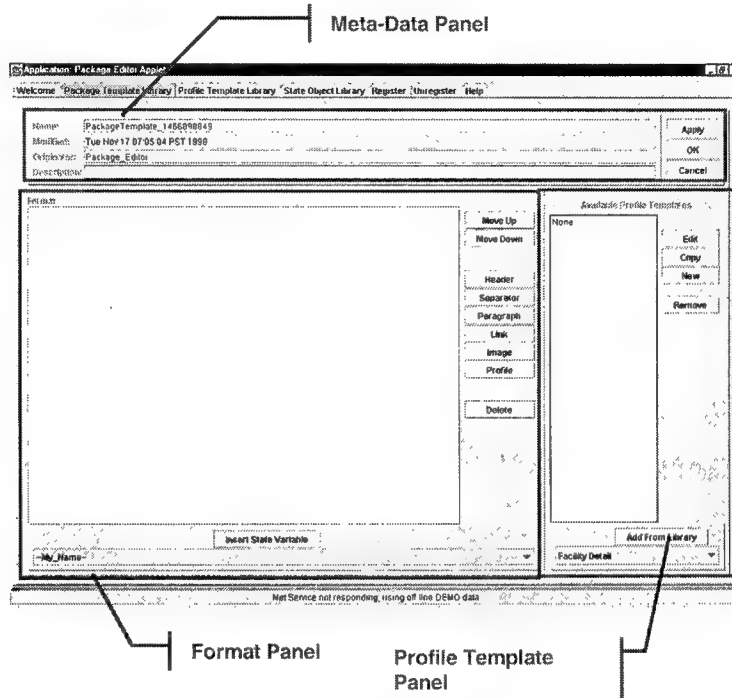
Within the Meta-data Panel general information about the Package Template is stored. Namely, the name of the Package Template, the date of last modification (this field is read-only and is modified by the system each time the Package Template is modified), and the originator of the Package Template. This field (as is the case of all the others) allows the user to input anything they want without validity checking of any type; however, it is intended to be used to identify either the original author or the person who last modified it. The description field can be used to identify in further detail what the Package Template's queries are all about. The Meta-Data Panel also has a button set associated with it. A detailed view of this panel is shown below.

Name of Object (Package Template, Profile Template, State Object)

Date Object was last modified (read-only, provided by system)

Name: | Facility Monitoring
Modified: | 6-22-98
Originator: | Package Editor
Description: | Template for Facility Monitoring

Apply
OK
Cancel

Originator (who or what created this object)

User specified Description of object

"Save" Button Set
Apply: Save but don't leave screen
OK: Save and leave screen
Cancel: Don't save and leave screen

The "Save" Button Set provides a way for the user to save or cancel the current changes being made.

The Profile Template Panel contains the list of Profile Templates associated with this particular Package Template. The Profile Template Panel is dominated by the Profile List. This list has a **List Button Set** associated with it, and works much like the Profile Template Library screen works. A distinction is made here, however, because the list of Profile Templates displayed here only exists within the Package Template. Some of the items in the Profile Template list might have started in the Profile Template Library but once they are copied into a particular Package Template the profile is "decoupled" from the library. Any changes made to a Profile Template within a Package Template have no effect on the original Profile Template in the Library. However, the user can choose to save the changes made to a Profile Template back into the Profile Library under a different name.

Profile Template List
List of Profile Template that will be satisfied within this Package

List Button Set

Available Profile Templates

None

Edit

Copy

New

Remove

Add From Library

Facility Detail

Profile Template Library Panel
Drop-down list to provide access (drop-in) to members of the Profile Template Library
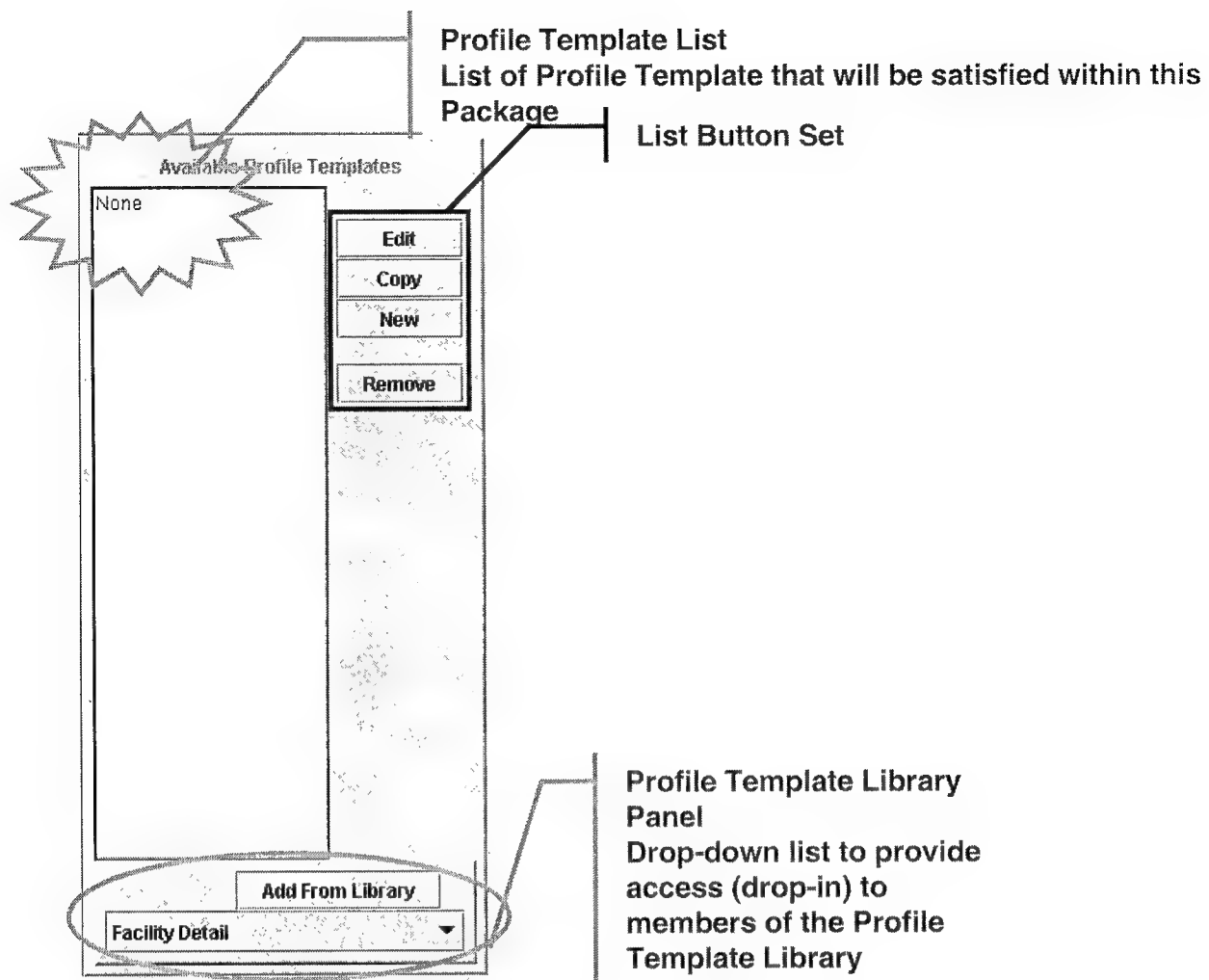
The Profile Template Panel, above, has an additional section associated with it that the Profile Template Library screen does not have: the Profile Template Library Panel. This provides a way for the user to copy Profile Templates from the Library to the Package Template. To operate this, and all similar types of drop-down menu selections, the user clicks on the arrow of the drop-down. When the list is displayed the user clicks on the appropriate selection (scrolling up or down as necessary). When the selection is made the user then must click on the "Add From Library" button. (In other circumstances the button will be labeled differently). When the Profile Template is added to the Profile Template list the WIP system will automatically append a number value to 1) remind the user that the Profile Template is a copy of the Library version of the Profile Template and 2) make the name unique, a system requirement.

State Variables

Facility Detail
Facility_Lookup
Airfield Description
Missile InstallationsSMF
Aircraft Reference
Seaport Description
country_reference
Facility Detail
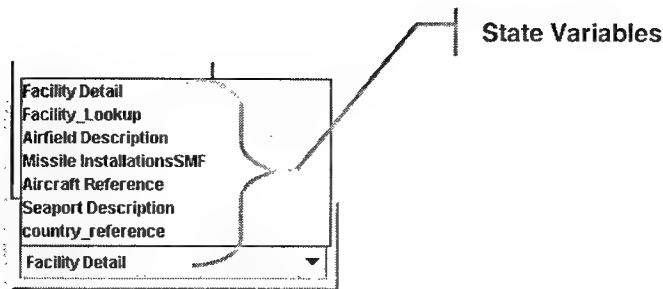
The remaining panel is the Display Layout Panel, shown below. It is in this space that the user defines how they wish the final displayed product to be formatted. This panel contains three button sets, the Format Objects Button Set, the Navigation Button Set and the Delete button, and a drop-down list panel, the State Variable Panel.
A user can choose to create a new Profile Template or modify an existing one by using one of the List Buttons. The details of this process will be discussed below.

Format Objects Button Set

The Format Objects Button Set contains the display objects that can be used to create the information product. There are six display objects:

- Header
- Separator
- Paragraph
- Link
- Image
- Profile

Formatting Workspace
Display area for creating a package's display format

Format

Move Up
Move Down

"Navigation" Button Set
Buttons to move objects
up and down

Header
Separator
Paragraph
Link
Image
Profile

"Format Objects" Button Set
Header
Separator
Paragraph
Link
Image
Profile

Delete

Button to remove selected object

State Variable Panel
Drop-down list to provide access (drop-in) to State Variables

Insert State Variable
~My_Name~

Header

The Header object is analogous to the <H1>, <H2>…<H6> tags in the HTML specification. It is intended as a one line title or caption; however, the user can take advantage of the object any way they choose. The Header object has two parameters: Font Size and Text. The font size is selected from a list, the choices are Small, Medium and Large. The Text parameter is the text the user wants displayed.

Separator

The separator object is analogous to the <HR> tag in HTML. It is used to visibly separate items in the display format with a horizontal line.

Paragraph

The Paragraph object is used to allow the user to annotate the information product with a section of text of arbitrary length. The paragraph will be rendered in the viewer's default size and font. The only parameter required is the text itself.

Link

The Link object allows the user to place in the product a hyper-link to an arbitrary URL. The user can use this feature as they see fit. The two parameters required are the Label and the URL. The Label is the text that will appear as the link. For example if the text were "This is a test link" and the URL was http://www.state.gov then the words This is a test link would be identified as a hyper-link to the US State Dept website.

Image

The Image object is very similar to the Link object (above) in that it allows the user to place in the product an image and a hyper-link to an arbitrary image URL. The two parameters required are the Label and the image URL. The Label is the text that will appear, as the link (currently not implemented). The currently implemented version displays a thumbnail of the image (in a system fixed size). When the image is clicked the full-size image is displayed.

Profile

The Profile object represents the results of a profile. There is only one editable parameter the user can change with this object: the Placement. The Placement refers to whether the results are placed "in-line" meaning as just another object displayed in the product or "link"ed which means that instead of the actual result being present in the product, a link to the result appears.

Header Display Object
Used for single-line annotation
Font Size (Small | Medium | Large)
Text (Free input, can include state variables)

Separator Display Object
Displays a line in final product (aesthetic)

Profile Display Object
Results of a Profile
Placement (Inline | Link)

Paragraph Display Object
Used for multi-line annotation
Text (Free input, can include state variables)

Link Display Object
Defines a hyper-link
(static)
Label (Free input)
Reference (URL)

Image Display Object
Defines an image to be displayed
(static)
Label (Free input)
Reference (URL)

Navigation Button Set

The Navigation Button Set is comprised of two buttons "Move Up" and "Move Down". These are used to change the placement of individual display objects in the product. To use them the user selects an object in the Formatting workspace and then clicks on the appropriate button to either move the object up or down in the list.

State Variable Panel

The State Variable Panel works the same as the *Profile Template Library Panel* (described above). However, in this case the drop-down list contains valid State Variables and the action button is labeled "Insert State Variable". State Variables can be inserted into most of the display objects and are most commonly used in Headers and Paragraphs.

State Variables

~My_Name~
~My_Command~
~My_Mission~
~My_Current_City~
~My_Current_Country~
~My_Target_City~
~My_Target_Country~
~Country_Disposition~
~My_Current_City~

Application: Package Editor Applet

Welcome | Package Template Library | Profile Template Library | State Object Library | Register | Unregister | Help

Name: Facility Monitoring
Modified: 8-22-98
Originator: Package Editor
Description: Template for Facility Monitoring

Apply
OK
Cancel

Format

Header   Font Size   Medium ▼
Facility Monitoring for Countries in: ~Region~

Separator

Header   Font Size   Medium ▼
The ~Facility_Category~ in
~Country_Disposition~ Countries in ~Region~

Profile   Placement   Inline ▼
Name: facilities_Bio_Plant

Header   Font Size   Medium ▼
The ~Facility_Category1~ in
~Country_Disposition~ Countries in ~Region~

Profile   Placement   Inline ▼
Name: facilities_Chem_Plant

Header   Font Size   Medium ▼
The ~Facility_Category2~ in
~Country_Disposition~ Countries in ~Region~

Profile   Placement   inline ▼

Move Up
Move Down

Header
Separator
Paragraph
Link
Image
Profile

Delete

Available Profile Templates

country_reference
Airport_Names
facilities_Bio_Plant
facilities_Chem_Plant
facilities_Nuc_Plant

Edit
Copy
New
Remove

Insert State Variable
~My_Name~

Add From Library
Facility Detail

Net Service not responding, using off-line DEMO data

Editing a Profile Template

A Profile Template can be edited via two paths. One path is by moving to the Profile Template Library tab, selecting a Profile Template from the list and either copying or editing the selected object. The other, and more utilized way is by editing the Profile Template from the list within a Package Template. While the form allows access to the entire Library, the latter views the data from a Package Template centric view, the more intuitive path for most users. Discussed here will be the path though the Package Template Library. The editing methods for the two paths identical with the exception that this path includes an additional set of buttons that allows the user to save the current Profile Template into the Profile Template Library.

Profile
Template
Meta Data
Panel

Profile
Template
Editor

Profile Template Editor

The Profile Template editor is organized it three sections and implemented as three
"tabs". The sections are: Conditions, Query Body and Query Format

Conditions
(Meta-data)
  Query Lang
  Life Span
  Frequency

Query Body
  Query Def

Query Format
  Display Spec

Conditions

The Conditions section contains meta-data about the profile. It contains a meta-data panel and addition fields. The fields implemented in the current version of WIP are not actually used – the current WIP Query Service (SIMS) does not support the values. The fields are included as placeholders for future implementations.

Query Body

The Query Body is the actual query specification that will be satisfied. WIP currently implements two distinct query editors. The first and most general is the so called Text Editor. This editor is just a free-field edit area. The only amenity is that WIP provides a list of valid State Variables that the user can insert into the query expression.
The second editor that WIP provides is the SQL3 Editor. This editor specializes the tasks needed to perform an SQL3 query. (SIMS uses SQL3 as its query language). Standard SQL3 queries can be broken down into three parts or clauses: the From clause, the Select clause and the Where clause. The From clause specifies which objects the user is interested in querying. The Select clause identifies the specific attributes the user wants returned as a result of the query and the Where clause describes the constraints to be used when processing the queries. The WIP SQL3 editor puts each one of the clause types on a different tab. The editor is very simplistic and provides no real validity checking; however, if the tabs are completed in the order provided (From, Select, Where) then the system will limit the users choices within a tab based on the specification in the previous tab.
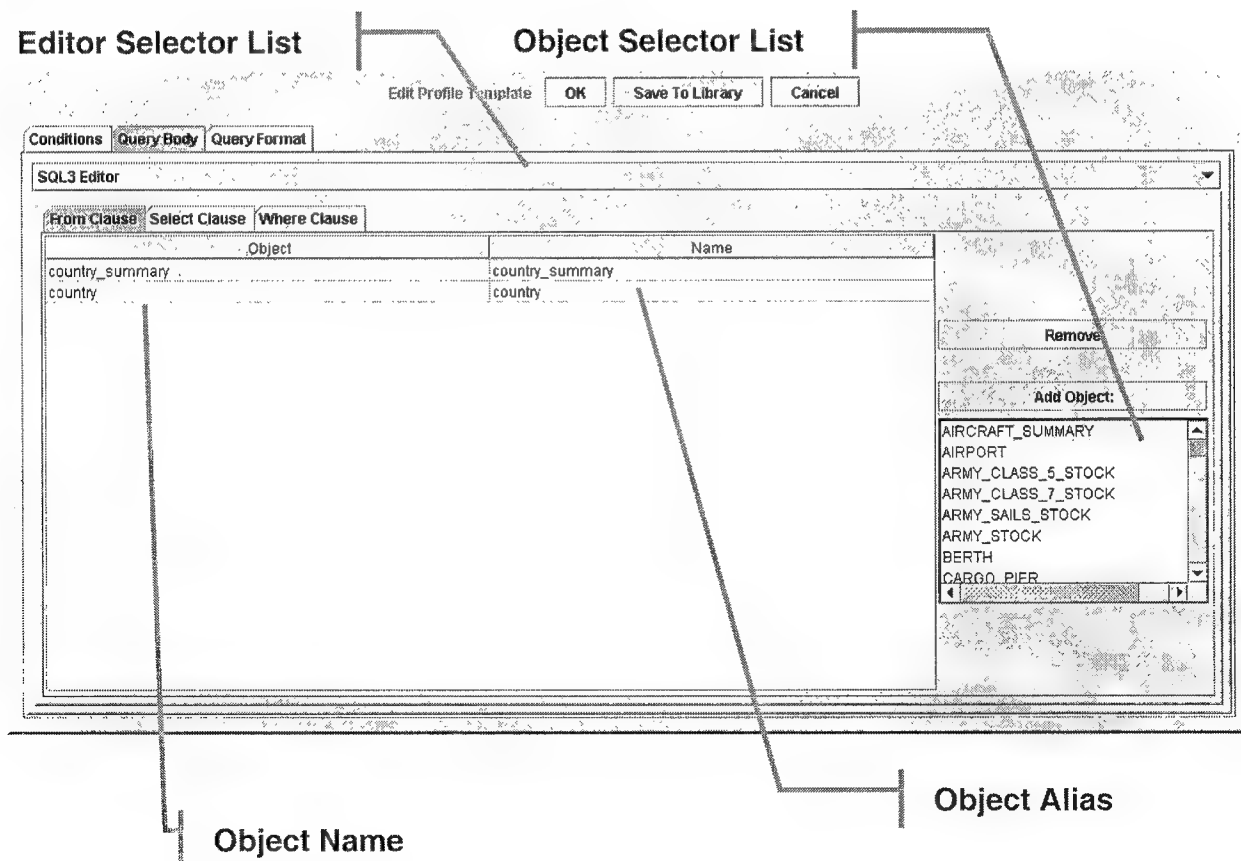
For instance, based on the objects selected in the From tab the user's choices of attributes within the Select tab will be limited to only those that are members of the selected objects.

Attribute Selector List

Selected Attribute List
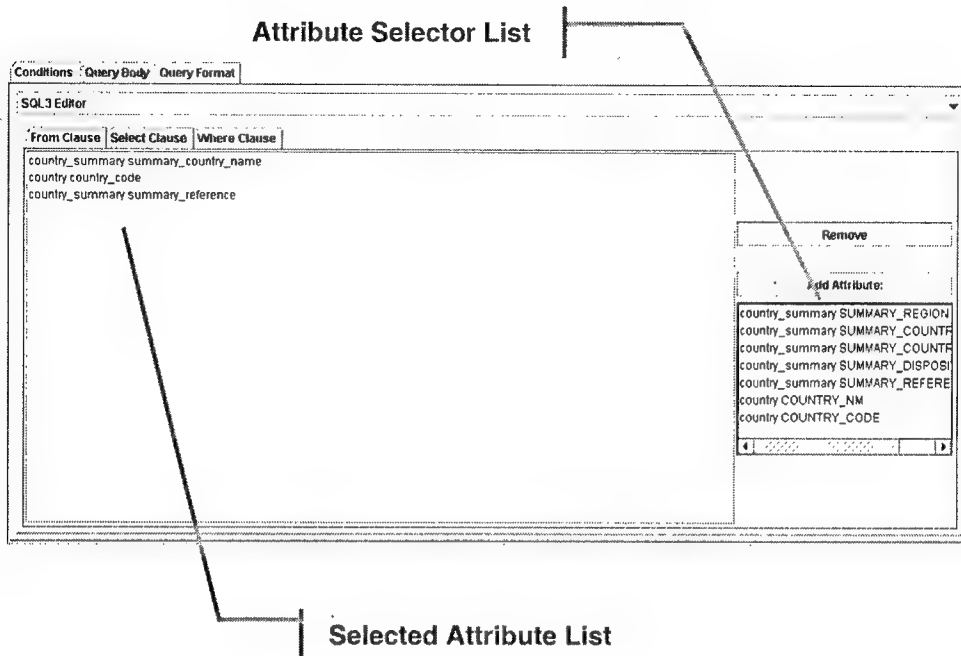
Within the Where tab the user is provided with two lists, one for State Variables and another with the list of valid attributes. This list is consistent with the objects selected from within the From tab.

State Variable Selector List

Attribute Selector List

Query Constraint Statement
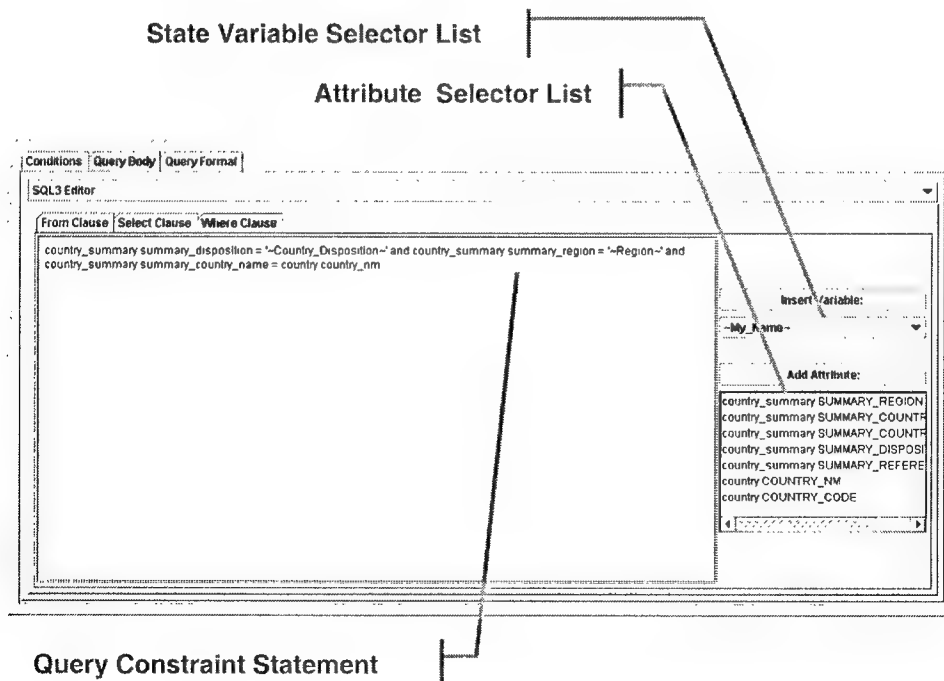
The Warfighter's Information Packager Package Editor was designed to be mutable over time. Although WIP only support two editors currently, it was architected to support multiple editors and ISX expects to install different editors in the future.

Query Format

The user can clarify how they wish the results of a query to be displayed in the Query Format tab. The first aspect of the display is the general layout. The result can either be displayed in a table format with column headers or in the so-called Label Record format. The label record format displays each record together, vertically with the attribute label on the left and the value on the right. Each attribute for a record is displayed and then the pattern repeats.
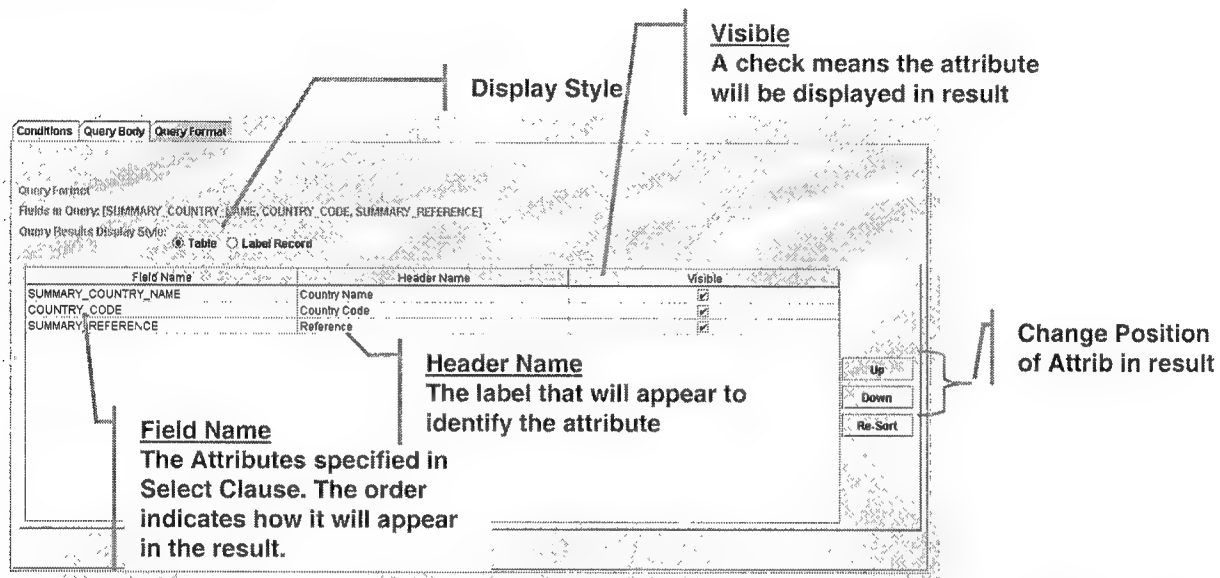
The order table within the Query Format tab allows the user to identify in what order they wish the attributes to appear, what the attribute label should be and finally whether or not a particular attribute should be displayed.

After each of the Conditions, Query Body and Query Format tabs is completed the user can choose to merely save the Profile Template into the current Package Template or to also save it into the Profile Template Library so others can use it also.

State Object Library

After the Package Template has been specified the user needs to select an appropriate State Object to associate with it for registration. The State Object selection page is very similar to the Package Template selection page. To illustrate the details of the information product we viewed in the beginning we can choose the "Hostile Countries in North Africa" State Object.
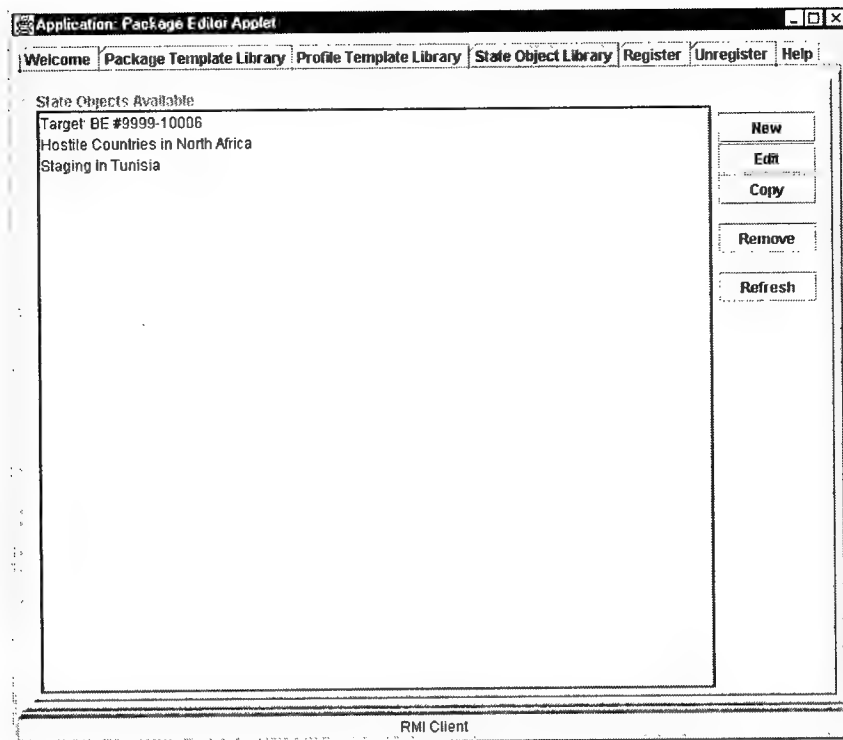
The State Object editor screen has three main sections: the Meta-data Panel, the variable editing table and the Package Template preview.
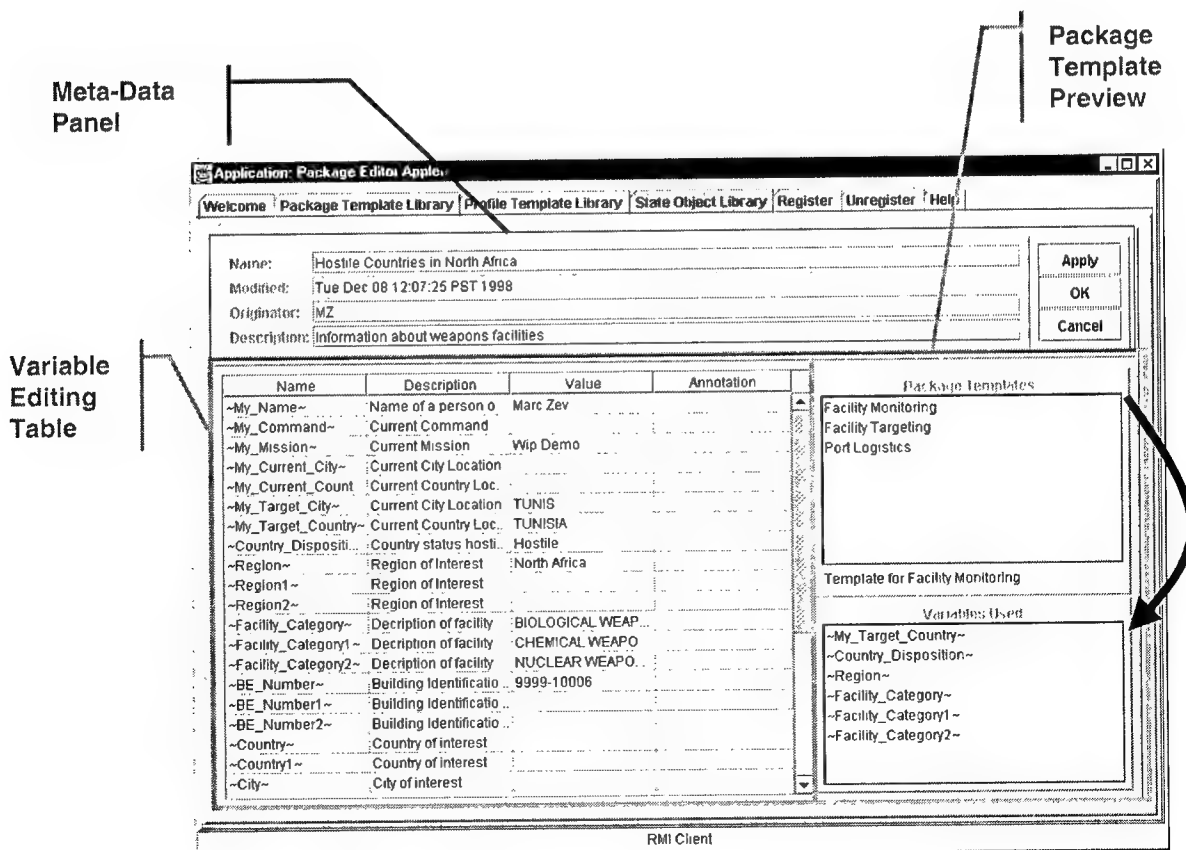
The meta-data panel is the same as we have seen elsewhere. The Variable Editing table has four columns. The two left-most columns, Name and Description are read-only and are set at start-time. The remaining two columns, Value and Annotation are assigned by the user. The idea is that the user will assign values to the State Variables that are used in a particular Package Template. The user can assign values to State Variables that are not used – this will have no adverse effect. The Annotation column is used for the user to write notes additional to the description field provide. To insure that all the required State Variables are assigned for a particular Package Template the user can use the Package Template Preview Panel. This panel has two lists. The top list is the list of Package Templates that reside in the Package Template Library. When the user selects one of the Package Templates the lower list is filled with the State Variables that appear in that Package Template. The user can then use the list as a guide to assign values in the Variable Editing Table.

Registration

Once the user has saved the State Object into the library, a Package can be registered with WIP. This is done by moving to the Registration tab.
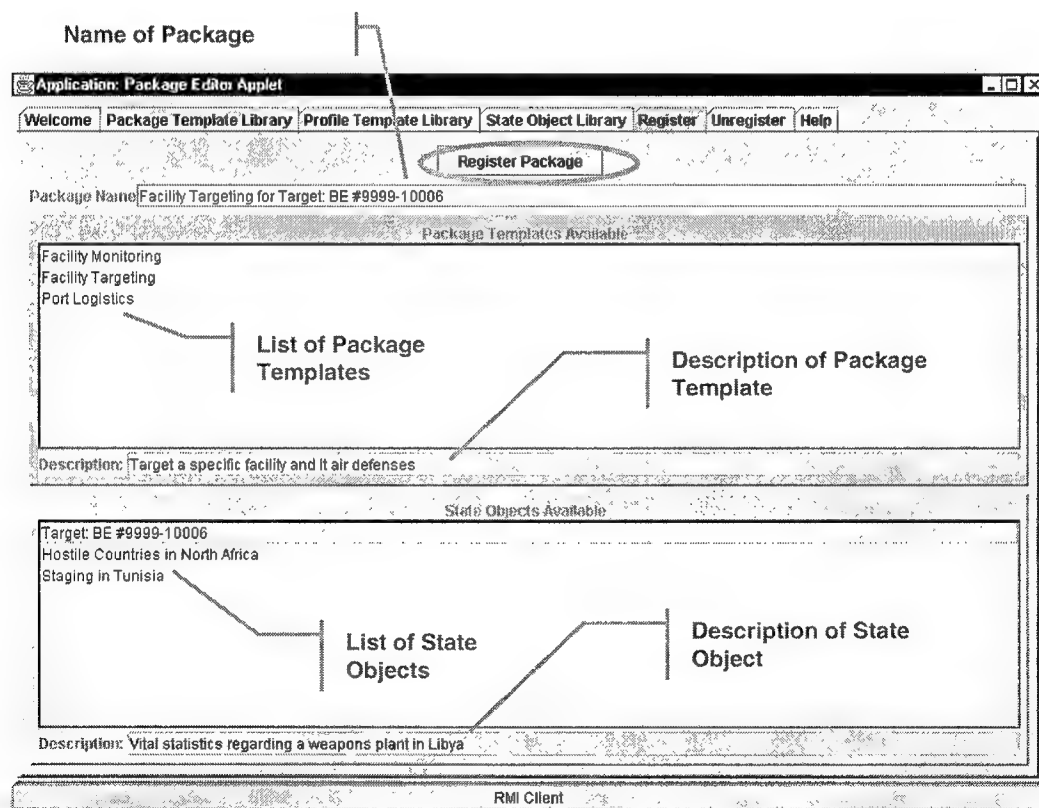
The Registration screen has three sections. The top (light blue) section contains the list of Package Templates available in the Library. The bottom (salmon colored) section is the list of State Objects available. Within each section there is a Description field which displays the Description meta-data field for the appropriate selected object. At the top of

the screen is the Package Name field. The name of the package will automatically be created as the combination of the Package Template name and the State Object name joined by the word "for". The user can change this name. After a selection has been made in each section the user can click on the *Register Package* button at the top of the page and the new package will be initiated.

Unregister

Within the Unregister tab screen there is a list of all the registered packages. The user can select a registered Package from the list and then click on the *Unregister Package* button at the top of the page.
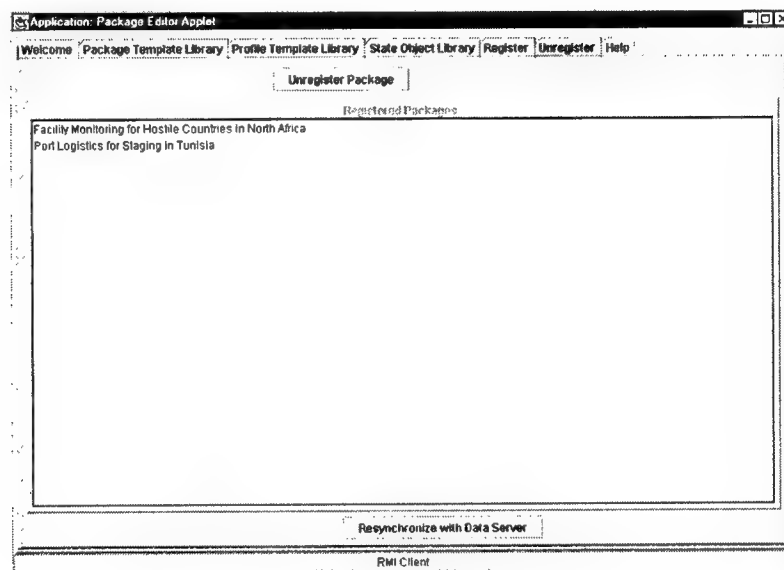
Even though the Warfighter's Information Packager is a robust system it was developed as a prototype system. The consequence of this is that although WIP will support multiple users in principle all the appropriate integrity checks were not put in place; therefore, problems can arise when multiple users are using the system at one time. To help insure the validity of the data displayed in any particular instance of the Package Editor, WIP has provided a means for re-instantiating the data while running. This is done by clicking on the *Resynchronize with Data Server* button at the bottom of the Unregister tab screen.

Summary

The proceeding guide provided a quick walk through of the Warfighter's Information Packager User Interfaces. This is presented as an exemplar case, and should not be construed as the only path a user can take through the system. Other navigational paths are available depending on the user's goals and interests.

Product Packaging for BADD Final Report

Appendix B:

Example Queries for Warfighter's Information Packager

The following is a list of exemplar ad hoc queries. They are modest, both in terms of the number of joins and number of returned tuples. In some cases information has been included to modify the query so it might return other interesting data.

The queries have been formulated to refer to parts of the domain which are not already exercised in the predefined set of Package and Profile templates already in the WIP demo.

1. What are the overall dimensions of any (notional) transport ships longer than 800 ft?

    This query returns 4 ships

    ```
    select n.vehicle_type_name, n.vehicle_length,
    n.ship_beam,n.ship_max_draft, n.ship_height
    from notional_transport_ship n
    where n.vehicle_length > 800
    ```

2. Info about all harbors in Long Beach

    This query returns 3 harbors

    ```
    select h.geoloc_code, h.harbor_name,
    h.mean_tidal_range, h.swell_height,
    h.min_anchorage_depth, h.max_anchorage_depth
    from harbor h
    where h.geographic_name  = 'LONG BEACH'
    ```

3. Info about all wharves in Long Beach harbor with more than 100,000 cf COVERED storage capacity

    This query returns 6 wharves

    ```
    select w.geoloc_code, w.wharf_berth_identifier,
    w.wharf_covered_storage_capacity,
    w.wharf_container_storage_capacity,
    w.wharf_cargo_crane_qty, w.container_crane_qty,
    w.wharf_length
    ```

```
from cargo_wharf w, geographic_location g
where g.geographic_name = 'LONG BEACH' and
g.geoloc_code = w.geoloc_code and
w.wharf_covered_storage_capacity > 100000
```

4. Info about all wharves in Long Beach harbor with more than 10,000 cf
    CONTAINER storage capacity

    This query returns 2 wharves

```
select w.geoloc_code, w.wharf_berth_identifier,
w.wharf_covered_storage_capacity,
w.wharf_container_storage_capacity,
w.wharf_cargo_crane_qty, w.container_crane_qty,
w.wharf_length
from cargo_wharf w, geographic_location g
where g.geographic_name = 'LONG BEACH' and
g.geoloc_code = w.geoloc_code and
w.wharf_container_storage_capacity > 10000
```

5. Geographic info about hospitals in the United Kingdom (may also try type =
    SCHOOL, BAY, TOWER, CHANNEL, RECREATIONAL AREA, PASSAGE,
    FUEL DEPOT) (may also try any major allied country)

    Returns geolocs of around 20 hospitals

```
select h.geoloc_code, h.geographic_name, h.lat, h.long
from geographic_location h, country c,
installation_type_info i
where i.installation_type_code =
h.installation_type_code and i.installation_type_name
= 'HOSPITAL' and h.geo_country_code = c.country_code
and c.country_nm = 'UNITED KINGDOM'
```

6. Static info (no stocks) about all 120MM ammunition NOTE: this query can
    take a long long time.

Returns at least 20 ammunition item types

```
select i.dod_id_code, i.fsc, i.niin, i.nomenclature,
i.price, i.volume, i.weight
from class_5_item i
where i.nomenclature like '%120MM%'
```

7. Info about ammunition stocks: G890 hand grenades in condition code C: [serviceable/priority issue]

Returns 16 stocked items with counts

(good with condition_code A, B, C, D, F, H, K, P)
(try changing also to grenades G884, G895, G916, G924)
(with guided missile PV04 use condition_code = B)
(with 175mm propellant explosive D361 use cc A, B, C, D, F or N)

```
select s.ammo_depot_name, s.condition_code,
s.dod_id_code, s.quantity_on_hand,
s.serviceable_quantity, s.supply_point,
c.condition_status, c.condition_qualification
from army_class_5_stock s, condition_info c
where c.condition_code = s.condition_code and
s.dod_id_code = 'G890' and c.condition_code = 'C'
```

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NAVAL TRAINING SYSTEMS CENTER                      1
ATTN:  ROBERT BREAUX/CODE 252
12350 RESEARCH PARKWAY
ORLANDO FL 32826-3224



DR JOHN SALASIN                                    1
DARPA/ITO
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA 22203-1714



DR BARRY BOEHM                                     1
DIR, USC CENTER FOR SW ENGINEERING
COMPUTER SCIENCE DEPT
UNIV OF SOUTHERN CALIFORNIA
LOS ANGELES CA 90089-0781


DR STEVE CROSS                                     1
CARNEGIE MELLON UNIVERSITY
SCHOOL OF COMPUTER SCIENCE
PITTSBURGH PA 15213-3891



DR MARK MAYBURY                                    1
MITRE CORPORATION
ADVANCED INFO SYS TECH: G041
BURLINTON ROAD, M/S K-329
BEDFORD MA 01730


ISX                                                1
ATTN:  MR. SCOTT FOUSE
4353 PARK TERRACE DRIVE
WESTLAKE VILLAGE,CA 91361


MR GARY EDWARDS                                    1
ISX
433 PARK TERRACE DRIVE
WESTLAKE VILLAGE CA 91361
```

DR ED WALKER   1
BBN SYSTEMS & TECH CORPORATION
10 MOULTON STREET
CAMBRIDGE MA 02238

LEE ERMAN   1
CIMFLEX TEKNOWLEDGE
1810 EMBACADERO ROAD
P.O. BOX 10119
PALO ALTO CA 94303

DR. DAVE GUNNING   1
DARPA/ISO
3701 NORTH FAIRFAX DRIVE
ARLINGTON VA   22203-1714

DAN WELD   1
UNIVERSITY OF WASHINGTON
DEPART OF COMPUTER SCIENCE & ENGIN
BOX 352350
SEATTLE, WA 98195-2350

STEPHEN SODERLAND   1
UNIVERSITY OF WASHINGTON
DEPT OF COMPUTER SCIENCE & ENGIN
BOX 352350
SEATTLE, WA 98195-2350

DR. MICHAEL PITTARELLI   1
COMPUTER SCIENCE DEPART
SUNY INST OF TECH AT UTICA/ROME
P.O. BOX 3050
UTICA, NY 13504-3050

CAPRARO TECHNOLOGIES, INC   1
ATTN: GERARD CAPRARO
311 TURNER ST.
UTICA, NY 13501

USC/ISI   1
ATTN: BOB MCGREGOR
4676 ADMIRALTY WAY
MARINA DEL REY, CA 90292

SRI INTERNATIONAL   1
ATTN: ENRIQUE RUSPINI
333 RAVENSWOOD AVE
MENLO PARK, CA 94025

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DARTMOUTH COLLEGE                                    1
ATTN:   DANIELA RUS
DEPT OF COMPUTER SCIENCE
11 ROPE FERRY ROAD
HANOVER, NH 03755-3510

UNIVERSITY OF FLORIDA                                1
ATTN:   ERIC HANSON
CISE DEPT 456 CSE
GAINESVILLE, FL 32611-6120

CARNEGIE MELLON UNIVERSITY                           1
ATTN:   TOM MITCHELL
COMPUTER SCIENCE DEPARTMENT
PITTSBURGH, PA 15213-3890

CARNEGIE MELLON UNIVERSITY                           1
ATTN:   MARK CRAVEN
COMPUTER SCIENCE DEPARTMENT
PITTSBURGH, PA 15213-3890

UNIVERSITY OF ROCHESTER                              1
ATTN:   JAMES ALLEN
DEPARTMENT OF COMPUTER SCIENCE
ROCHESTER, NY 14627

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ATTN:  LIZ LIDDY
2-121 CENTER FOR SCIENCE & TECH
SYRACUSE, NY 13244

WRIGHT STATE UNIVERSITY                              1
ATTN:   DR. BRUCE BERRA
DEPART OF COMPUTER SCIENCE & ENGIN
DAYTON, OHIO 45435-0001

UNIVERSITY OF FLORIDA                                1
ATTN:   SHARMA CHAKRAVARTHY
COMPUTER & INFOR SCIENCE DEPART
GAINESVILLE, FL 32622-6125

KESTREL INSTITUTE                                    1
ATTN:   DAVID ESPINOSA
3260 HILLVIEW AVENUE
PALO ALTO, CA 94304
```

STOLLER-HENKE ASSOCIATES   1
ATTN: T.J. GOAN
2016 BELLE MONTI AVENUE
BELMONT, CA 94002

USC/INFORMATION SCIENCE INSTITUTE   1
ATTN: DR. CARL KESSELMAN
11474 ADMIRALTY WAY, SUITE 1001
MARINA DEL REY, CA 90292

MASSACHUSETTS INSTITUTE OF TECH   1
ATTN: DR. MICHAELE SIEGEL
SLOAN SCHOOL
77 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02139

USC/INFORMATION SCIENCE INSTITUTE   1
ATTN: DR. WILLIAM SWARTHOUT
11474 ADMIRALTY WAY, SUITE 1001
MARINA DEL REY, CA 90292

STANFORD UNIVERSITY   1
ATTN: DR. GIO WIEDERHOLD
857 SIERRA STREET
STANFORD
SANTA CLARA COUNTY, CA 94305-4125

NCCOSC RDTE DIV D44208   1
ATTN: LEAH WONG
53245 PATTERSON ROAD
SAN DIEGO, CA 92152-7151

SPAWAR SYSTEM CENTER   1
ATTN: LES ANDERSON
271 CATALINA BLVD, CODE 413
SAN DIEGO CA 92151

GEORGE MASON UNIVERSITY   1
ATTN: SUSHIL JAJODIA
ISSE DEPT
FAIRFAX, VA 22030-4444

DIRNSA   1
ATTN: MICHAEL R. WARE
DOD, NSA/CSS (R23)
FT. GEORGE G. MEADE MD 20755-6000

DR. JIM RICHARDSON
3660 TECHNOLOGY DRIVE
MINNEAPOLIS, MN 55418   1

LOUISIANA STATE UNIVERSITY   1
COMPUTER SCIENCE DEPT
ATTN: DR. PETER CHEN
257 COATES HALL
BATON ROUGE, LA 70803

INSTITUTE OF TECH DEPT OF COMP SCI   1
ATTN: DR. JAIDEEP SRIVASTAVA
4-192 EE/CS
200 UNION ST SE
MINNEAPOLIS, MN 55455

GTE/BBN   1
ATTN: MAURICE M. MCNEIL
9655 GRANITE RIDGE DRIVE
SUITE 245
SAN DIEGO, CA 92123

UNIVERSITY OF FLORIDA   1
ATTN: DR. SHARMA CHAKRAVARTHY
E470 CSE BUILDING
GAINESVILLE, FL 32611-6125

AFRL/IFT   1
525 BROOKS ROAD
ROME, NY 13441-4505

AFRL/IFTM   1
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ROME, NY 13441-4505

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